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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|----------------------|------------------|
| 10/005,104 | 12/03/2001 | Bjorn A. Bjerke | 010548 | 9458 |
| 23696 | 7590 | 07/25/2005 | EXAMINER | |
| Qualcomm Incorporated Patents Department 5775 Morehouse Drive San Diego, CA 92121-1714 | | | GHULAMALI, QUTBUDDIN | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2637 | |

DATE MAILED: 07/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|-----------------|---------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/005,104 | BJERKE ET AL. |
| Examiner | Art Unit | |
| Qutub Ghulamali | 2637 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 03 December 2001.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-46 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>3/12/02, 11/7/03</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Acknowledgment

1. This Office Action is responsive to the Remarks filed on 03/15/2005.
2. Applicant has elected Invention I and claims 1-46, remain in the application. Claims 47-68 have been cancelled without prejudice.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-9, 14-18, 20-30, 34-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Nguyen et al, (US IEEE Publication VTS-2000).

Regarding claims 1 and 27, Nguyen discloses a method for recovering data transmitted in a wireless communication system, comprising:

receiving a plurality of modulation symbols for a plurality of transmitted coded bits (page 2395; section 2); deriving first a priori information for the coded bits based on the received modulation symbols and second a priori information for the coded bits (pages 2395, 2398; sections 2.1, 2.6); decoding (decoder, detector) the first a priori information to derive the second a priori information (page 2396; section 2.3);

repeating the deriving and decoding a plurality of times (iterating) (col. 6, lines 26-29), and determining decoded bits for the transmitted coded bits based in part on the second a priori information (pages 2396, 2397; section 2.3).

Regarding claim 2, Nguyen discloses deriving soft-decision symbols for the coded bits based on the received modulation symbols and the second a priori information, and wherein the first a priori information is derived based on the soft-decision symbols and the second a priori Information (page col. 2, lines 1-8).

Regarding claims 3, 15, 16, 23, 28, 29, and 30 Nguyen discloses the soft-decision symbols are represented as log-likelihood ratios (LLRs) (page 2396; section 2.3). Regarding claims 4, 17, Nguyen discloses the soft-decision symbols comprise channel information and extrinsic information (page 2397; section 2.3 (cont.)).

Regarding claim 5, Nguyen discloses soft decision comprises information for one or more spatial sub channels used to transmit the plurality of modulation symbols (page 2395; first paragraph; section 2).

Regarding claim 6, Nguyen discloses deinterleaving the first a priori information, wherein the deinterleaved first a priori information is decoded (page 2396; sections 2.2, 2.3); and interleaving the second a priori information, wherein the interleaved second a priori is used to derive the first a priori information (page 2395; sections 2, 2.1).

Regarding claim 7, Nguyen discloses the wireless communication system is a multiple-input multiple-output (MIMO) system (formed by M transmit antennas and N receive antennas) (page 2395; section 2).

Regarding claims 8 and 40, Nguyen discloses MIMO system implements orthogonal frequency division multiplexing (OFDM) (page 2394; section 1).

Regarding claim 9, Nguyen discloses a method for recovering data transmitted in a multiple-input multiple-output (MIMO) system comprising:

receiving a plurality of modulation symbols for a plurality of coded bits transmitted via a plurality of frequency sub channels of a plurality of transmit antennas (page 2395; section 2);

deriving soft-decision symbols for the coded bits based on the received modulation symbols and second a priori information for the coded bits;

deriving first a priori information for the coded bits based on the soft-decision symbols and the second a priori information;

decoding the first a priori information to derive the second a priori information;

repeating the deriving the first a priori information and the decoding the first a priori information a plurality of times, and

determining decoded bits for the transmitted coded bits based in part on the second a priori information.

Regarding claim 14, Nguyen discloses:

deinterleaving the first a priori information, wherein the deinterleaved first a priori information is decoded (pages 2396, 2397, section 2.3); and

interleaving the second a priori information, wherein the interleaved second a priori is used to derive the soft-decision symbols (pages 2396, 2397, section 2.3).

Regarding claim 18, Nguyen discloses the soft symbols comprise for each coded bit extrinsic information extracted from the other coded bits (page 2397; section 2.3).

Regarding claim 20, Nguyen discloses a serial concatenated convolutional decoding scheme (page 2394, col. 1, section 1).

Regarding claim 21, Nguyen discloses decoding is based on a convolutional decoding scheme (page 2394, col. 2).

Regarding claim 22, Nguyen discloses decoding is based on a block decoding scheme (page 2394, col. 2).

Regarding claim 24, Nguyen discloses each transmit antenna is based on a respective decoding scheme (page 2395, section 2).

Regarding claim 25, Nguyen discloses plurality of modulation symbols are derived based on a non-Gray modulation scheme (page 2394, col. 1, section 1).

Regarding claim 26, Nguyen discloses modulation symbols for each transmit antenna are derived based on a respective modulation scheme (page 2395, section 2).

Regarding claims 34, 35 and 36, Nguyen discloses at least one decoder is provided for each independently coded data stream to be decoded by the receiver and is operative to perform decoding on the first a priori information (page 2396, section 2.2, fig. 3).

Regarding claims 37, 38 and 39, Nguyen discloses channel estimator operative to estimate one or more characteristics of a communication channel via which the plurality of modulation symbols are received (page 2394, section 1); and a transmitter unit operative to process and transmit channel state information indicative of the estimated channel characteristics (page 2394, section 1).

Regarding claims 41, 42 and 43, Nguyen discloses a terminal, a base station, and access point comprising the receiver unit (see page 2394, section 1).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 10-13, 19, 31-33, 44-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen in view of Marzetta (USP 6,307,882).

Regarding claims 10 and 31, Nguyen discloses all limitations of the claim as disclosed in 9 and 27 above including the soft-decision symbols for the coded bits transmitted from each transmit antenna are derived based on the recovered modulation symbols for the transmit antenna and the second a priori information for the transmit antenna, except recovering the modulation symbols for each transmit antenna by nulling the modulation symbols for other transmit antennas. Marzetta in a similar field of endeavor discloses recovering the modulation symbols for each transmit antenna by nulling the modulation symbols for other transmit antennas (col. 6, lines 29-50). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use modulation symbol recovery for each transmit antenna by nulling the symbols as taught by Marzetta in the system method of Nguyen so that the received symbols transmitted by the transmitter can be related in an equivalent manner.

Regarding claims 11 and 32, Nguyen discloses all limitations of the claim as disclosed in 9 and 27 above, except pre-multiplying the received modulation symbols with a plurality of nulling matrices to derive the recovered modulation symbols for the plurality of frequency

subchannels of the transmit antenna. Marzetta in a similar field of endeavor discloses pre-multiplying the received modulation symbols with a plurality of nulling matrices to derive the recovered modulation symbols for the plurality of frequency subchannels of the transmit antenna (col. 6, lines 40-59). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use modulation symbol recovery with nulling (cancellation) operation of symbols as taught by Marzetta in the method of Nguyen so as to allow the receiver to relate to transmission of symbols transmitted by the transmitter in an efficient and to establish equivalency.

Regarding claims 12, 13, and 33, Nguyen discloses all limitations of the claim as disclosed in 9 and 27 except for symbol recovery by nulling (cancellation of) the symbols. Marzetta in a similar field of endeavor discloses for each transmit antenna except the last transmit antenna recovering the modulation symbols for the transmit antenna by nulling the modulation symbols for other transmit antennas from input modulation symbols for the transmit antenna col. 6, lines 40-59); canceling interference due to the recovered modulation symbols from the input modulation symbols (col. 6, lines 29-40); and wherein, the input modulation symbols for the first transmit antenna are the received modulation symbols and the input modulation symbols for each subsequent transmit antenna are the interference-cancelled modulation symbols from the current transmit antenna (col. 6, lines 60-67; col. 7, lines 1-24). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use modulation symbol recovery with nulling cancellation)

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peration of symbols as taught by Marzetta in the method of Nguyen so as to allow the receiver to relate to transmission of symbols transmitted by the transmitter in an efficient and to establish equivalency.

Regarding claim 19, Nguyen discloses a serial concatenated convolutional decoding scheme. However, the parallel concatenated convolutional decoding scheme is well known in the art of turbo codes utilizing the parallel concatenated coding scheme and as eluded to by Nguyen (see page 2394, column 2) making it quite obvious to use by a person of ordinary skill in the art.

Regarding claim 44, the steps claimed as apparatus is nothing more than restating the function of the specific components of the apparatus as claimed and therefore, it would have been obvious, considering the aforementioned rejection for the method claim 9.

Regarding claim 45, the steps claimed as apparatus is nothing more than restating the function of the specific components of the apparatus as claimed and therefore, it would have been obvious, considering the aforementioned rejection for the method claims 9, 10.

Regarding claim 46, the steps claimed as apparatus is nothing more than restating the function of the specific components of the apparatus as claimed and therefore, it would have been obvious, considering the aforementioned rejection for the method claims 9, 14.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US Patents:

Gerlach et al (USP 6499128) discloses an iterated soft detection decoding of block codes.

Gupta (US Pub. 2003/0112901) discloses a method and apparatus for determining LLR with precoding.

Wang (US Pub. 2004/0174939) shows a near optimal multiple input multiple output (MIMO) channel detection and estimation.

Shattil (US Pub. 2004/0100897) discloses carrier interferometry coding with application in wireless communication.

Cameron et al (US Pub. 20040/240590) discloses decoder design adaptable to decode coded signals.

Magee et al (US Pub. 2003/0086504) shows a system and method for soft slicing and constellation point estimation.

Publications:

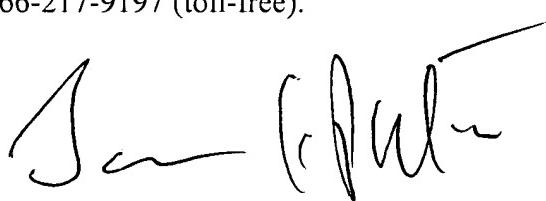
Alamouti, Siavash, "A simple Transmit Diversity Technique for Wireless Communication", IEEE, Journal on select area in communication, vol. 16, No. 8, October 1998.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Qutub Ghulamali whose telephone number is (571) 272-3014. The examiner can normally be reached on Monday-Friday from 8:00AM - 5:00PM.

9. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

QG.
July 21, 2005.



**JAY K. PATEL
SUPERVISORY PATENT EXAMINER**